Eco-toxicological analysis of free-ranging cetaceans from the North-western Mediterranean Sea

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Abstract

The numerous anthropogenic activities occurring nowadays in the North-western Mediterranean Sea strongly affect top predators such as marine mammals, especially through the bioaccumulation of lipophilic contaminants. In order to assess the eco-toxicological status of local living cetaceans blubber biopsies were collected between 2006 and 2013. Selected persistent organic pollutants POPs (31PCBs, 15 organochlorine compounds, 9 PBDEs and 17 PCDD/Fs) were analyzed in 49 long-finned pilot whales *Globicephala melas*, 61 sperm whales *Physeter macrocephalus* and 70 fin whales *Balaenoptera physalus*. $\delta^{13}C$, $\delta^{15}N$ values and POPs levels were assessed through IR-MS and GC-MS respectively. To assess the toxic potency of the dioxin-like compounds, the TEQ approach was applied. $\delta^{15}N$ values were 12.2±1.3‰ for sperm whales, 10.5±0.7‰ for pilot whales and 7.7±0.8‰ in fin whales, positioning sperm whales at higher trophic levels. $\delta^{13}C$ instead was similar and amounted to −17.3±0.4‰, −17.8±0.3‰ and −18.7±0.4‰ respectively. Pilot whales presented higher concentrations than sperm whales for ΣPCBs (38666±25731ng.g^{-1} lw and 22849±15566ng.g^{-1} lw respectively), ΣPBDEs (712±412ng.g^{-1} lw and 347±173ng.g^{-1} lw respectively) and ΣDDTs (46081±37506ng.g^{-1} lw and 37647±38518ng.g^{-1} lw respectively). Fin whales presented the lowest values, in accordance with its trophic position (ΣPCBs: 5721±5180ng.g^{-1} lw, ΣPBDEs: 177±208ng.g^{-1} lw and ΣDDTs: 6643±5549ng.g^{-1} lw). The PCA analysis confirmed how p,p'DDT and p,p'DDE were influential in differentiating the species, as a consequence of their migratory behavior and distribution. Pollutant concentrations were significantly higher than both their Southern Hemisphere and North Atlantic counterparts, possibly due to the particular Mediterranean geomorphology, which influences pollutants distribution and recycle. Dioxin-like

PCBs accounted for over 80% of the total TEQ. This study demonstrated (1) an important exposure to pollutants of Mediterranean toothed-whales, often surpassing the estimated threshold toxicity value of 17000ng.g^{-1} lw for blubber in marine mammals; and (2) how their geographical distribution can influence the pollutants profile and concentrations.

Keywords: chemical tracer, biopsy, blubber, trophic level, toxicity, Mediterranean